Chemistry / Physics Review
Answer Section

SHORT ANSWER

1. ANS:

K_2S - potassium sulfide
Ag_2O - silver oxide
sodium oxide - Na_2O
lithium iodide – LiI
beryllium chloride - $BeCl_2$
$AlBr_3$ - aluminum bromide
ZnF_2 - zinc fluoride
calcium nitride - Ca_3N_2
potassium phosphide - K_3P
magnesium hydride - MgH_2

REF: UC LOC: UBC1

2. ANS:

$CaCl_2$ - calcium chloride
BaI_2 - barium iodide
hydrogen chloride - HCl
aluminum nitride - AlN
zinc sulfide - ZnS
Mg_3P_2 - magnesium phosphide
Na_3N - sodium nitride
potassium oxide - K_2O
sodium fluoride - NaF
potassium bromide - KBr

REF: UC LOC: UBC1

3. ANS:

PbI_2 - lead(II) iodide
Fe_2O_3 - iron(III) oxide
iron(II) bromide - $FeBr_2$
copper(I) nitride - Cu_3N
SnF_4 - tin(IV) fluoride
Cu_2S - copper(I) sulfide
tin(II) phosphide - Sn_3P_2
lead(IV) oxide - PbO_2

REF: UC LOC: UBC1

4. ANS:

$AgNO_3$ - silver nitrate
$CaSO_4$ - calcium sulfate
magnesium carbonate - $MgCO_3$
copper(II) sulfate - $CuSO_4$
$Pb(ClO_3)_2$ - lead(II) chlorate
K_3PO_4 - potassium phosphate
calcium hydrogen carbonate - $Ca(HCO_3)_2$
iron(II) hydroxide - $Fe(OH)_2$

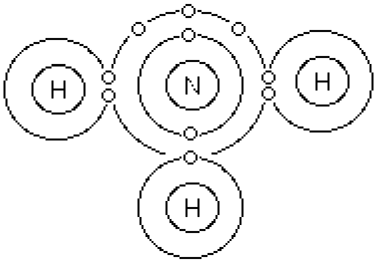
REF: UC LOC: UBC1

5. ANS:

Na_2CO_3 - sodium carbonate
$Cu(OH)_2$ - copper(II) hydroxide
zinc chlorate - $Zn(ClO_3)_2$
potassium sulfate - K_2SO_4
$Sn(NO_3)_2$ - tin(II) nitrate
$Al(HCO_3)_3$ - aluminum hydrogen carbonate
calcium phosphate - $Ca_3(PO_4)_2$
lead(IV) carbonate - $Pb(CO_3)_2$

REF: UC LOC: UBC1

6. ANS:



REF: AS LOC: DS2

7. ANS:

SO_2 - sulfur dioxide	CF_4 - carbon tetrafluoride
NBr_3 - nitrogen tribromide	CS_2 - carbon disulfide
carbon dioxide - CO_2	nitrogen phosphide - NP
silicon tetrabromide - $SiBr_4$	chlorine oxide - Cl_2O

REF: UC LOC: UBC1

8. ANS:
a. skeleton
b. in front of
c. formulas
d. $4\ Na + 1\ O_2 \rightarrow 2\ Na_2O$

REF: UC LOC: DS2

9. ANS:
$2\ PbS + 3\ O_2 \rightarrow 2\ PbO + 2\ SO_2$

REF: UC LOC: DS2

10. ANS:
$MnO_2 + 4\ HCl \rightarrow MnCl_2 + 2\ H_2O + Cl_2$

REF: UC LOC: DS2

11. ANS:
$Cu + 2\ H_2SO_4 \rightarrow CuSO_4 + 2\ H_2O + SO_2$

REF: UC LOC: DS2

12. ANS:
$Al_4C_3 + 12\ H_2\ O \rightarrow 4\ Al(OH)_3 + 3\ CH_4$

REF: UC LOC: DS2

13. ANS:
a. pentane + oxygen $\rightarrow$ carbon dioxide + water
b. $C_5\ H_{12} + 8\ O_2 \rightarrow 5\ CO_2 + 6\ H_2\ O$
c. heat or energy

REF: UC LOC: UBC3

14. ANS:

$CH_4 + 2\ O_2 \rightarrow 2\ H_2O + C$

REF: UC LOC: UBC3

15. ANS:

a. $C_4H_8 + 6\ O_2 \rightarrow 4\ CO_2 + 4\ H_2O$
b. combustion

REF: UC LOC: UBC3

16. ANS:

a. heat
b. oxygen
c. decompose or break up
d. oxygen

REF: UC LOC: RST2

17. ANS:

a. $C_6H_{12}O_6 \rightarrow 6\ H_2O + 6\ C$
b. decomposition

REF: UC LOC: UBC3, DS2

18. ANS:

a.	$2\ HgO \rightarrow 2\ Hg + O_2$	decomposition
b.	$4\ Al + 3\ O_2 \rightarrow 2\ Al_2O_3$	synthesis
c.	$SO_3 + H_2O \rightarrow H_2SO_4$	synthesis

REF: UC LOC: UBC3

19. ANS:

a. synthesis
b. decomposition
c. synthesis
d. decomposition

REF: UC LOC: UBC3

20. ANS:

a.	$4\ Na + O_2 \rightarrow 2\ Na_2O$	synthesis
b.	$2\ Ag_2O \rightarrow 4\ Ag + O_2$	decomposition
c.	$MgCO_3 \rightarrow MgO + CO_2$	decomposition
d.	$2\ Al + 3\ Br_2 \rightarrow 2\ AlBr_3$	synthesis

REF: UC LOC: UBC3, DS2

21. ANS:

a. double displacement
b. single displacement
c. single displacement
d. double displacement

REF: UC LOC: UBC3

22. ANS:

a. single displacement

b. double displacement
c. single displacement
d. double displacement

REF: UC LOC: UBC3

23. ANS:
a. $Bi_2O_3 + 3\ H_2 \rightarrow 3\ H_2O + 2\ Bi$
b. single displacement

REF: UC LOC: DS2

24. ANS:
a. collide
b. number or frequency
c. increasing
d. effective

REF: UC LOC: UBC4

25. ANS:
a. sour
b. soluble
c. conduct
d. hydrogen
e. carbonate or hydrogen carbonate (either one)

REF: UC LOC: UBC5

26. ANS:
a. bitter
b. slippery
c. soluble
d. electricity
e. alkaline

REF: UC LOC: UBC5

27. ANS:
a. Acids: HCl H_2SO_4 Bases: KOH $Al(OH)_3$
b. Acid: "H" or hydrogen is common
c. Base: "OH" or hydroxide is common
d. HOH, water or H_2O

REF: UC LOC: UBC5

28. ANS:
a. $NaOH_{(aq)} \rightarrow Na^+_{(aq} + OH^-_{(aq)}$
$HCl_{(aq)} \rightarrow H^+_{(aq)} + Cl^-_{(aq)}$
b. $H^+_{(aq)}$ or hydrogen ion
c. $OH^-_{(aq)}$ or hydroxide ion

REF: UC LOC: DS2

29. ANS:
a. $Ca(OH)_2$: base
b. HBr: acid

c. Carbonic acid or hydrogen carbonate: acid
d. $MgCl_2$: neither
e. nitric acid or hydrogen nitrate: acid
f. lithium hydroxide: base

REF: UC LOC: DS8

30. ANS:

(a) $\Delta d = 35.0 \text{ km}$

$\Delta t = 169 \text{ min}$

$v_{av} = ? \text{ km/h}$

$$\Delta t = 169 \text{ min} \times \frac{1\text{h}}{60.0 \text{ min}} = 2.82\text{h}$$

$$v_{av} = \frac{\Delta d}{\Delta t}$$

$$= \frac{35.0 \text{ km}}{2.82 \text{ h}}$$

$= 12.4$ km/h (rounded to 3 significant digits)

The average speed of the aircraft was 12.4 km/h.

(b) $\Delta d = v_{av}\, \Delta t$

$= 12.4 \text{ km/h} \times 5.3 \text{ h}$

$= 66$ km (rounded to 2 significant digits)

Assuming he maintained the same average speed, then he would cover a total of 66 km.

REF: AS LOC: UBC4

31. ANS:

(a) $\Delta d = 28\,577.5 \text{ km} - 28\,456.0 \text{ km} = 121.5 \text{ km}$

$\Delta t = 1.35\text{h}$

$v_{av} = ? \text{ km/h}$

$$v_{av} = \frac{\Delta d}{\Delta t}$$

$$= \frac{121.5 \text{ km}}{1.35 \text{ h}}$$

$= 90.0$ km/h (3 significant digits)

The average speed of the car is 90.0 km/h.

(b) $$\Delta t = \frac{\Delta d}{v_{av}}$$

$$= \frac{170 \text{ km}}{90.0 \text{ km/h}}$$

$$= 1.89 \text{ h (rounded to 3 significant digits)}$$

The family will make the trip from Oshawa to Niagara Falls in 1.89 hours.

REF: AS LOC: UBC4

32. ANS:

(a) $$v = 100 \text{ km/h}$$

$$\Delta t = 3.0 \text{ s} \times \frac{1 \text{ min}}{60 \text{ s}} \times \frac{1 \text{ h}}{60 \text{ min}} = 0.000\ 83 \text{ h}$$

$$\Delta d = ?$$

$$\Delta d = v\ \Delta t$$

$$= 100 \text{ km/h} \times 0.000\ 83 \text{ h}$$

$$= 0.083 \text{ km}$$

$$0.083 \text{ km} \times \frac{1000 \text{ m}}{1 \text{ km}} = 83 \text{ m}$$

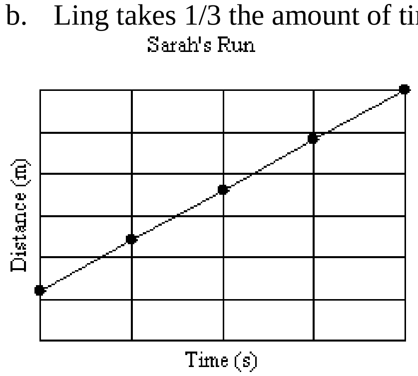
The car travelled 83 metres in the 3.0 seconds it took the driver to recover the french fry.

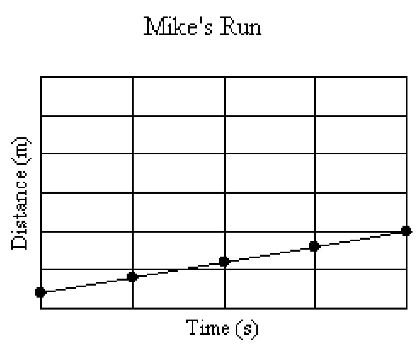
(b) Saving time and convenience are the main benefits of eating while driving.
(c) Distraction of the driver from traffic and road conditions, which could lead to an accident, are some of the risks involved when eating while driving.
(d) Some possible ways to reduce the risk are: keep your attention on traffic and road conditions, avoid eating while driving as much as possible, and limit your eating to foods that will be very easy and quick to eat.

REF: MC LOC: UBC4, RST1

33. ANS:

a. Ling travels three times as far as Mike during the same time interval.
b. Ling takes 1/3 the amount of time to run the same distance as Mike.

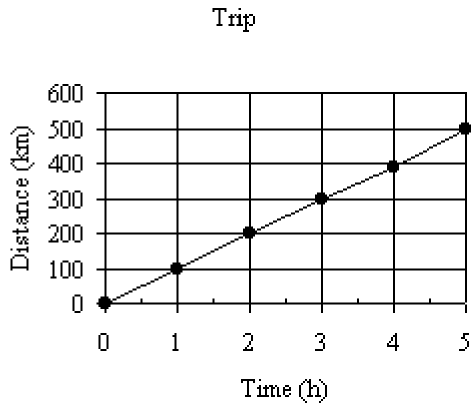




c. Ling's distance-time graph would have a slope three times as steep as Mike's.

REF: UC LOC: UBC4, DS4

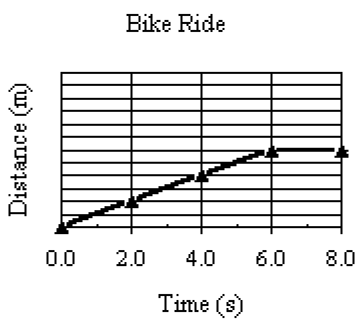
34. ANS:
a.



b. The distance traveled after 1.5 hours was 150 km.
c. The time required to travel 400 km was 4 hours.
d. The speed was not constant because the truck did not travel equal distances in equal intervals of time.

REF: AS LOC: UBC4, UBC6, DS4

35. ANS:



REF: AS LOC: UBC6, DS4

36. ANS:

$v_1 = 10.00\ \text{km/h}$

$a_{av} = 1\ 000.0\ \text{km/h}^2$

$\Delta t = 30.0\ \text{s} \times \dfrac{1\ \text{min}}{60\ \text{s}} \times \dfrac{1\ \text{h}}{60\ \text{min}} = 0.008\ 33\ \text{h}$

$v_2 = ?$

$$\begin{aligned} v_2 &= v_1 + a_{av}\,\Delta t \\ &= 10.00\ \text{km/h} + 1\ 000\ \text{km/h}^2 \times 0.008\ 33\ \text{h} \\ &= 10.00\ \text{km/h} + 8.33\ \text{km/h} \\ &= 18.33\ \text{km/h} \end{aligned}$$

The final speed of the jet in 30.0 s would be 18.33 km/h.

REF: MC LOC: UBC7

37. ANS:

a.

$$v_1 = 4.0 \text{ m/s}$$

$$v_2 = 15.0 \text{ m/s}$$

$$\Delta t = 5.2 \text{ s}$$

$$a_{av} = ?$$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(15.0 - 4.0) \text{ m/s}}{5.2 \text{ s}}$$

$$= 2.1 \text{ m/s}^2$$

The average acceleration of the roller blader is 2.1 m/s^2.

b. An acceleration of 2.1 m/s^2 means that the speed of the roller blader is increasing at a rate of 2.1 m/s every second.

REF: UC LOC: UBC7

38. ANS:

$$v_1 = 0.0 \text{ m/s}$$

$$v_2 = 6.0 \text{ m/s}$$

$$\Delta t = 4.0 \text{ s}$$

$$a_{av} = ?$$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(6.0 - 0.0)\text{m/s}}{4.0 \text{ s}}$$

$$= 1.5 \text{ m/s}^2$$

The average acceleration of the cyclist is 1.5 m/s^2.

REF: UC LOC: UBC7

39. ANS:

$v_1 = 20.0\text{ km/h}$

$v_2 = 50.0\text{ km/h}$

$a_{av} = 8.1\text{ (km/h)/s}$

$\Delta t = ?$

$$\Delta t = \frac{v_2 - v_1}{a_{av}}$$

$$= \frac{(50.0 - 20.0)\text{ km/h}}{8.1\text{ (km/h)/s}}$$

$$= 3.7\text{ s}$$

It will take 3.7 s for the car to accelerate from 20.0 km/h to 50.0 km/h.

REF: MC LOC: UBC7

40. ANS:

a. **Car A:**

$v_1 = 0.0\text{ km/h}$

$v_2 = 100.0\text{ km/h}$

$\Delta t = 8.3\text{ s}$

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(100.0 - 0.0)\text{km/h}}{8.3\text{ s}}$$

$= 12\text{ (km/h)/s}$ (rounded to 2 significant digits)

The average acceleration of Car A was 12 (km/h)/s.

Car B:

$v_1 = 0.0\text{ km/h}$

$v_2 = 100.0\text{ km/h}$

$\Delta t = 6.4\text{ s}$

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(100.0 - 0.0)\text{ km/h}}{6.4\text{ s}}$$

$= 16\text{ (km/h)/s}$ (rounded to 2 significant digits)

The average acceleration of Car A was 16 (km/h)/s.

Car C:

$v_1 = 0.0\text{ km/h}$

$v_2 = 100.0\text{ km/h}$

$\Delta t = 9.7\text{ s}$

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(100.0 - 0.0)\text{ km/h}}{9.7\text{ s}}$$

$= 10\text{ (km/h)/s}$ (rounded to 2 significant digits)

The average acceleration of Car A was 10 (km/h)/s.

b. Car C has the amount of average acceleration at 10 (km/h)/s.

REF: UC LOC: UBC7

41. ANS:

$v_1 = 2.0\text{ m/s}$

$v_2 = 15.0\text{ m/s}$

$a_{av} = 4.3\text{ m/s}^2$

$\Delta t = ?$

$$\Delta t = \frac{v_2 - v_1}{a_{av}}$$

$$= \frac{(15.0 - 2.0)\text{ m/s}}{4.3\text{ m/s}^2}$$

$= 3.0\text{ s}$ (rounded to 2 significant digits)

It took 3.0 s for the shark to accelerate from 2.0 m/s to 15.0 m/s.

REF: UC LOC: UBC7

42. ANS:

$v_1 = 4.0 \text{ m/s}$

$a_{av} = 2.0 \text{ m/s}^2$

$\Delta t = 3.0 \text{ s}$

$v_2 = ?$

$$v_2 = v_1 + a_{av}\,\Delta t$$

$$= 4.0 \text{ m/s} + 2.0 \text{ m/s}^2 \times 3.0 \text{ s}$$

$$= 4.0 \text{ m/s} + 6.0 \text{ m/s}$$

$$= 10 \text{ m/s}$$

The final speed of the jet in 3.0 s would be 10 m/s.

REF: UC LOC: UBC7

43. ANS:

$v_1 = 144.0 \text{ km/h}$

$v_2 = 0.00 \text{ km/h}$

$a_{av} = 155\ 000.0 \text{ km/h}^2$

$\Delta t = ?$

$$\Delta t = \frac{v_2 - v_1}{a_{av}}$$

$$= \frac{(0.00 - 144) \text{ km/h}}{-150\ 000.0 \text{ km/h}^2}$$

$$= 0.000\ 960 \text{ h (rounded to 3 significant digits)}$$

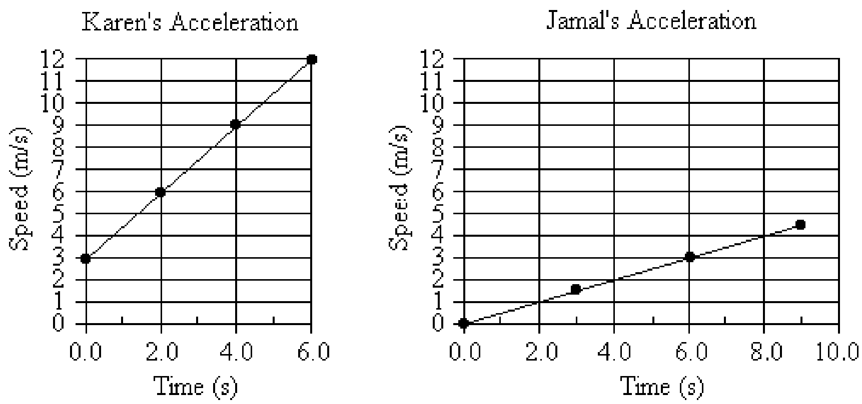
$$\Delta t = 0.000\ 960 \text{ h} \times \frac{60 \text{ min}}{1 \text{h}} \times \frac{60 \text{ s}}{1 \text{min}} = 3.46 \text{ s}$$

It took 3.46 s for the ball to accelerate from 144 m/s to 0.00 m/s.

REF: UC LOC: UBC7

44. ANS:

a.



b.

$v_1 = 9.0 \text{ m/s}$

$v_2 = 6.0 \text{ m/s}$

$\Delta t = (4.0 - 2.0)\text{s} = 2.0\text{s}$

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(9.0 - 6.0) \text{ m/s}}{2.0s}$$

$= 1.5 \text{ m/s}^2$ (rounded to 2 significant digits)

Karen's average acceleration is 1.5 m/s^2.

$v_1 = 1.5 \text{ m/s}$

$v_2 = 3.0 \text{ m/s}$

$\Delta t = (6.0 - 3.0) \text{ s} = 3.0 \text{ s}$

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(3.0 - 1.5) \text{ m/s}}{3.0 \text{ s}}$$

$= 0.5 \text{ m/s}^2$ (rounded to 2 significant digits)

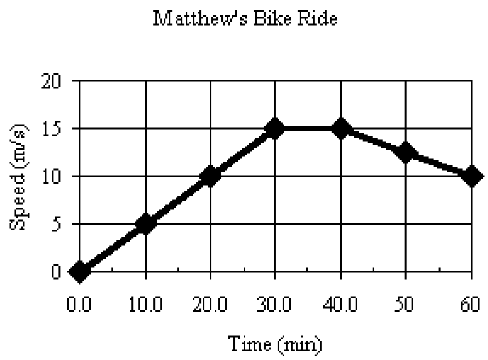
Jamal's average acceleration is 0.5 m/s^2.

Karen has the greater acceleration.

REF: UC LOC: UBC8

45. ANS:

a.



0 to 30 minutes:

$v_1 = 0.0$ m/s

$v_2 = 15.0$ m/s

$\Delta t = 30.0$ min

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(15.0 - 0.0)\text{ m/s}}{30.0\text{ min}}$$

$$= 0.50\text{ m/s/min(rounded to 2 significant digits)}$$

The average acceleration from 0.0 to 30.0 s was 0.50 m/s/min.

30 to 40 minutes:

$v_1 = 15.0$ m/s

$v_2 = 15.0$ m/s

$\Delta t = 10$ min

$a_{av} = ?$

$$a_{av} = \frac{v_2 - v_1}{\Delta t}$$

$$= \frac{(15.0 - 15.0)\text{ km/h}}{10.0\text{ min}}$$

$$= 0.00\text{ m/s / min(rounded to 3 significant digits)}$$

The average acceleration from 30 to 40 minutes was 0.00 m/s/min.

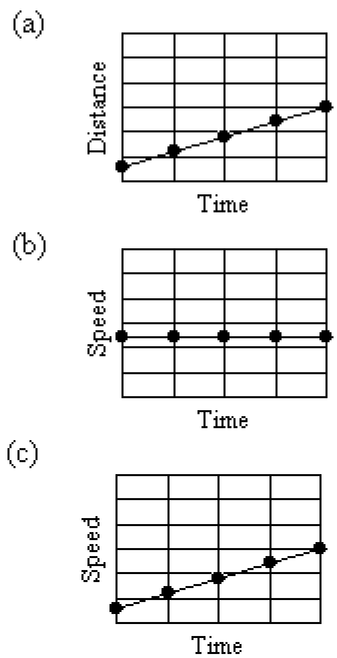
40 to 60 minutes:

The average acceleration from 30 to 40 minutes was 0.250 m/s/min.

b. The time interval distances from largest to smallest are 0 to 30 min, 30 to 40 min, and 40 to 60 min.

REF: UC LOC: UBC8, DS4

46. ANS:



REF: UC LOC: UBC8, DS4

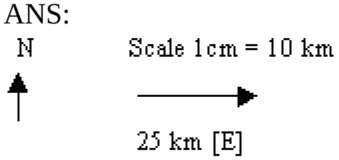
47. ANS:
If the line on a speed-time graph has a positive or negative slope, then it is accelerating.

REF: UC LOC: UBC8, DS4

48. ANS:
a. 15 yards [from the Toronto 5-yard line]
b. 10 yards [from the Toronto 5-yard line]
c. 10 yards [from the Toronto 5-yard line]
d. 20 yards

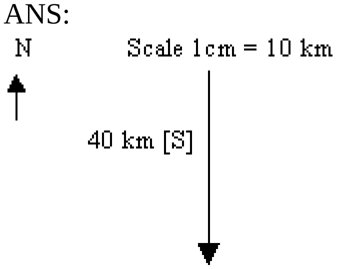
REF: UC LOC: UBC1

49. ANS:



REF: UC LOC: UBC1

50. ANS:



REF: UC LOC: UBC1

51. ANS:
Position is the distance and direction from a reference point, and displacement is the change in position.

REF: UC LOC: UBC1

52. ANS:
a. Join each subsequent vector by connecting the head end of the last vector to the tail end of the next vector.
b. Find the resultant vector by drawing an arrow from the tail of the first vector to the head of the last vector.

REF: UC LOC: UBC2

53. ANS:
Let [E] be positive and [W] be negative.

$\Delta\vec{d}_1 = 3 \text{ km [W]} = -3 \text{ km}$

$\Delta\vec{d}_2 = 15 \text{ km [E]} = +15 \text{ km}$

$\Delta\vec{d}_3 = 4 \text{ km [W]} = -4 \text{ km}$

$\Delta\vec{d}_r = \Delta\vec{d}_1 + \Delta\vec{d}_2 + \Delta\vec{d}_3$

$= -3 \text{ km} + +15 \text{ km} + -4 \text{ km}$

$= +8 \text{ km}$

The resultant displacement is + 8 km or 8 km [E].

REF: UC LOC: UBC2

54. ANS:
Let [E] be positive and [W] be negative.

$\Delta\vec{d}_1 = 3.5 \text{ km [E]} = +3.5 \text{ km}$

$\Delta\vec{d}_2 = 1.5 \text{ km [E]} = +1.5 \text{ km}$

$\Delta\vec{d}_3 = 4 \text{ km [W]} = -4 \text{ km}$

$\Delta\vec{d}_r = \Delta\vec{d}_1 + \Delta\vec{d}_2 + \Delta\vec{d}_3$

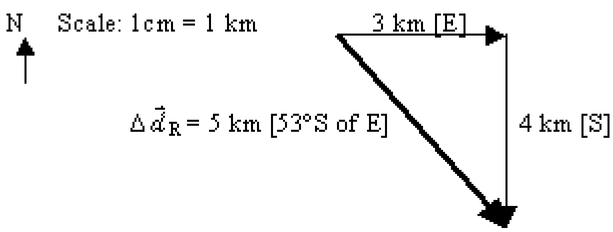
$= +3.5 \text{ km} + +1.5 \text{ km} + -4 \text{ km}$

$= +1 \text{ km}$

The resultant displacement is + 1 km or 1 km [E].

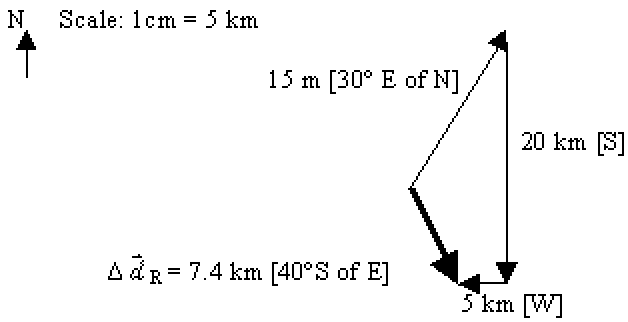
REF: UC LOC: UBC2

55. ANS:



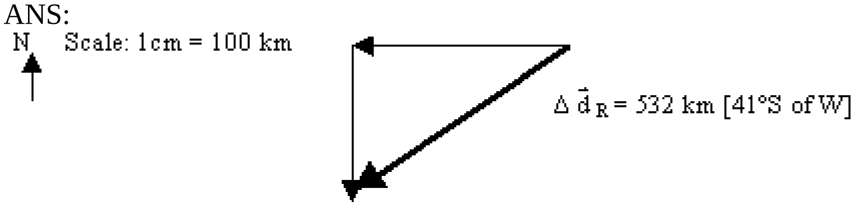
REF: UC LOC: UBC2

56. ANS:



REF: UC LOC: UBC2

57. ANS:



REF: UC LOC: UBC2

58. ANS:

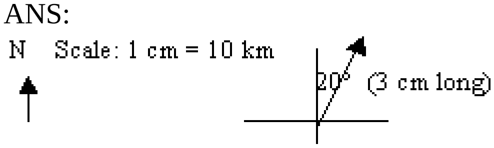
$$\left(\Delta \vec{d}_R\right)^2 = (0.75 \text{ m})^2 + (3.00 \text{ m})^2$$

$$\Delta \vec{d}_R = 3.09 \text{ m}$$

(rounded to three significant digits and 2 places after the decimal)
The ball travelled 2 × 3.09 m from one corner to the cushion and rebounding to the opposite corner or a total distance of 6.18 m.
The displacement was 1.50 m [S].

REF: UC LOC: UBC1, UBC2

59. ANS:



REF: UC LOC: UBC1

60. ANS:

First part of activity

$$\vec{v}1 = \frac{\Delta \vec{d}1}{\Delta t}$$

$$= \frac{150 \text{ m [E]}}{40 \text{ s}}$$

$$= 3.8 \text{ m/s [E]}$$

The velocity during the first part of his activity was 3.8 m/s [E].

Second part of activity

$$\vec{v}2 = \frac{\Delta \vec{d}2}{\Delta t}$$

$$= \frac{500 \text{ m [W]}}{350 \text{ s}}$$

$$= 1.43 \text{ m/s [W]}$$

The velocity during the second part of his activity was 1.43 m/s [W].
Average velocity for whole activity

$$\Delta \vec{d}_R = +150 \text{ m} + -500 \text{ m} = -350 \text{ m or } 350 \text{ m [W]}$$

$$\Delta t = 40 \text{ s} + 350 \text{ s} = 390 \text{ s}$$

$$\vec{v}_{av} = \frac{\Delta \vec{d}_R}{\Delta t}$$

$$= \frac{350 \text{ m [W]}}{390 \text{ s}}$$

$$= 0.897 \text{ m/s [W]}$$

The velocity during his whole activity was 0.897 m/s [W].

REF: UC LOC: UBC5

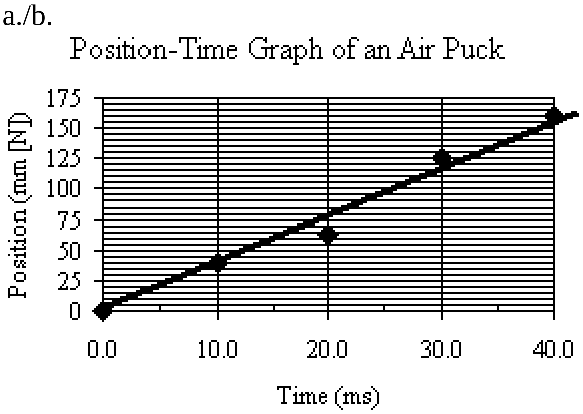
61. ANS:
The object has stopped south of the school for several minutes and then proceeds north at a fast, constant velocity until it reaches the school. The object then goes south away from the school for a few minutes at a slower, constant velocity.

REF: UC LOC: DS4

62. ANS:
The object is moving at a fast, constant velocity for several minutes north away from home. It then turns around and moves south toward home at a faster velocity in less time. It passes home, turns around, and goes back toward home at the same velocity as the original velocity in a few minutes.

REF: UC LOC: DS4

63. ANS:
a./b.



c. Instantaneous velocity at 20.0 ms = $\frac{(80-0)\text{ mm [N]}}{(20.0-0)\text{ ms}}$

$$= 4.0\text{ m/s [N]}\left(\text{accept +/– }0.25\text{ m/s}\right)$$

Instantaneous velocity at 40.0 ms = $\frac{(160-0)\text{ mm [N]}}{(40.0-0)\text{ ms}}$

$$= 4.0\text{ m/s [N]}\left(\text{accept +/– }0.25\text{ m/s}\right)$$

The instantaneous velocity at 20.0 ms and 40.0 ms is 4.0 m/s [N] (accept +/– 0.25 m/s).

d. Average velocity at 40.0 ms = $\frac{(160-0)\text{ mm[N]}}{(40.0-0)\text{ ms}}$

$$= 4.0\text{ m/s [N] }\left(\text{accept +/– }0.25\text{ m/s}\right)$$

The average velocity at 40.0 ms is 4.0 m/s [N] (accept +/– 0.25 m/s).

e. The instantaneous velocities and the average velocities are exactly the same because the slope of the best-fit line shows a constant velocity.

REF: UC LOC: UBC3, UBC6, DS4

64. ANS:
The slope of a straight-line segment is calculated by dividing the rise (change in position) by the run (change in time) of the line.

REF: UC LOC: UBC6

65. ANS:
A tangent (a straight line that just touches the curve at one point) is drawn to the curve at the given point. The slope of its tangent is calculated by dividing the rise (change in position) by the run (change in time) of the line.

REF: UC LOC: UBC6

66. ANS:
A positive slope means the object is moving in the direction defined as positive for the graph.

REF: UC LOC: UBC6

67. ANS:
A negative slope means the object is moving in the direction defined as negative for the graph.

REF: UC LOC: UBC6

68. ANS:
A horizontal line means that the object is not moving.

REF: UC LOC: UBC6

69. ANS:
The ball’s average velocity was +6.0 km/h or 6.0 km/h [SE].

REF: UC LOC: UBC6

70. ANS:

$\vec{v}_1 = 10 \text{ km/h[N]}$

$\vec{v}_2 = 10 \text{ km/h [N]}$

$\vec{v}_{av} = ?$

$$\vec{v}_{av} = \frac{\vec{v}_1 + \vec{v}_2}{2}$$

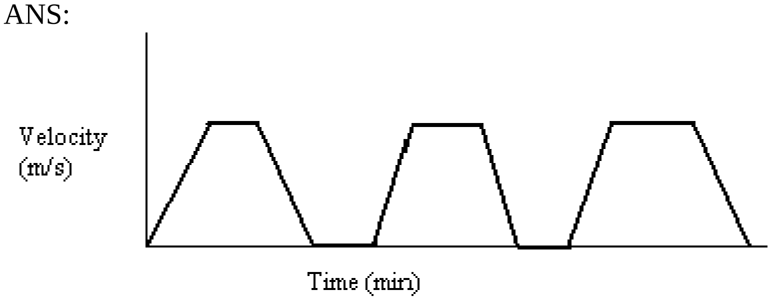
$$\vec{v}_{av} = \frac{14 \text{ km/h [N]}}{2}$$

$\vec{v}_{av} = 7.0 \text{ km/h [N]}$

Zane's average velocity was 7.0 km/h [N].

REF: UC LOC: UBC6

71. ANS:



REF: MC LOC: DS4

72. ANS:

$\vec{v}_1 = 60 \text{ km/h [N]}$

$\vec{v}_2 = 30 \text{ km/h [N]}$

$\vec{v}_{av} = ?$

$$\vec{v}_{av} = \frac{\vec{v}_1 + \vec{v}_2}{2}$$

$$\vec{v}_{av} = \frac{90 \text{ km/h [N]}}{2}$$

$\vec{v}_{av} = 45 \text{ km/h [N]}$

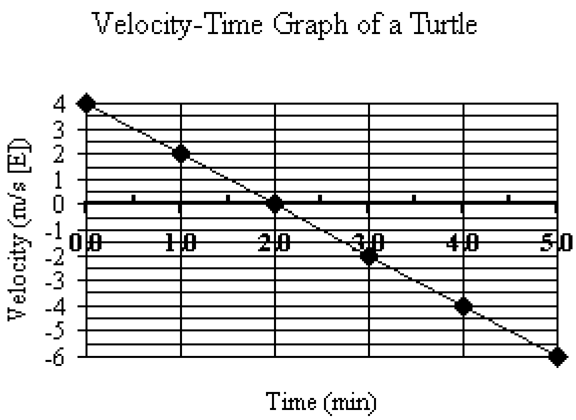
The average velocity of the car was 45 km/h [N].

REF: UC LOC: UBC6

73. ANS:

$\vec{v}_1 = +4.0 \text{ m/s}$

$\vec{v}_2 = -6.0 \text{ m/s}$



$t_1 = 0.0$ s
$t_2 = 5.0$ s

$$\text{Slope} = \frac{\text{rise}}{\text{run}}$$

$$= \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

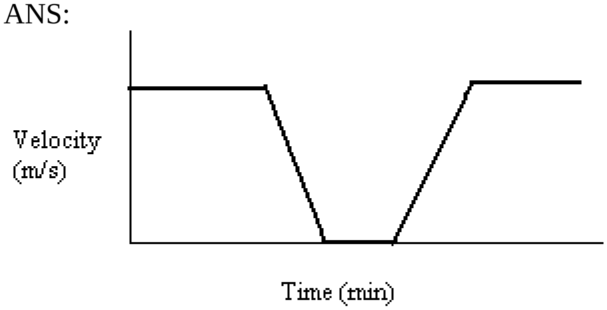
$$= \frac{(-6.0 - 4.0) \text{ m/s}}{(5.0 - 0.0) \text{ s}}$$

$$= -2 \text{ m/s}^2 \text{ or } 2 \text{ m/s}^2 \text{ [W]}$$

The average acceleration of the turtle is 2 m/s^2 [W].

REF: UC LOC: UBC7

74. ANS:



REF: MC LOC: DS4

75. ANS:

$$\vec{v}_1 = 40 \text{ km/h [N]}$$

$$\vec{v}_2 = 70 \text{ km/h [N]}$$

$$\Delta t = 4.0 \text{ s}$$

$$\vec{a}_{av} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$= \frac{(70 - 40)\text{(km/h)/s [N]}}{4.0 \text{ s}}$$

$$= 7.5 \text{ (km/h)/s [N] or } +7.5 \text{ (km/h)/s [N]}$$

The average acceleration of the car is 7.5 (km/h)/s [N].

REF: UC LOC: UBC7

76. ANS:

$$\vec{v}_1 = 0 \text{ km/h [right]}$$

$$\vec{a}_{av} = 36\ 000 \text{ km/h}^2 \text{ [right]}$$

$$\Delta t = 40.0 \text{ s} \times \frac{1 \text{ h}}{3600 \text{ s}} = 0.011\ 1 \text{ h}$$

$$\vec{v}_2 = ?$$

$$\vec{a}_{av} = \frac{\vec{v}_2 - \vec{v}_1}{\Delta t}$$

$$\vec{v}_2 = \vec{v}_1 + \vec{a}_{av}\Delta t$$

$$= 0 \text{ km/h [right]} + \left(36\ 000 \text{ km/h}^2 \text{ [right]}\right) \times 0.011\ 1 \text{ h}$$

$$= 400 \text{ km/h [right]}$$

The final velocity of the jet after 40.0 s is +400 km/h or 400 km/h [right].

REF: UC LOC: UBC7

77. ANS:

$\vec{a}_{av} = 5.00 \text{ m/s}^2 \text{ [left] or } -5.00 \text{ m/s}$

$\vec{v}_2 = 35.0 \text{ m/s [left] or } -35.0 \text{ m/s}$

$\Delta t = 5.00 \text{ s}$

$\vec{v}_1 = ?$

$$\begin{aligned}\vec{v}_1 &= \vec{v}_2 - \vec{a}_{av}\,\Delta t \\ &= (-35.0 \text{ m/s}) - \left(-5.00 \text{ m/s}^2\right)(5.00 \text{ s}) \\ &= (-35 \text{ m/s}) + 25 \text{ m/s} \\ &= -10 \text{ m/s or } 10 \text{ m/s [left]}\end{aligned}$$

The initial velocity of the motorcycle was 10 m/s [left].

REF: UC LOC: UBC7

78. ANS:

$\vec{v}_1 = 10 \text{ m/s[down]} = -10 \text{ m/s}$

$\vec{v}_2 = 20 \text{ m/s[down]} = -10 \text{ m/s}$

$\vec{a}_{av} = 10 \text{ m/s}^2 \text{ [down]} = -10 \text{ m/s}^2$

$\Delta t = ?$

$$\begin{aligned}\Delta t &= \frac{\vec{v}_2 - \vec{v}_1}{\vec{a}_{av}} \\ &= \frac{(-20 \text{ m/s}) - (-10 \text{ m/s})}{-10 \text{ m/s}^2} \\ &= \frac{-10 \text{ m/s}}{-10 \text{ m/s}^2} \\ &= -1.0 \text{ s}\end{aligned}$$

It takes 1.0 s for the penny to accelerate from – 10 m/s to –20 m/s.

REF: UC LOC: UBC7

79. ANS:

The negative sign indicates that the velocity is decreasing.

REF: UC LOC: UBC7

80. ANS:

$\vec{v}_1 = 2.0\text{ m/s [W]} = -2.0\text{ m/s}$

$\vec{v}_2 = 7.0\text{ m/s [W]} = -7.0\text{ m/s}$

$\Delta t = 3.4\text{ s}$

$\Delta \approx = ?$

$$\Delta \approx = \frac{(\vec{v}_1 + \vec{v}_2)}{2} \Delta t$$

$$= \frac{(-2.0\text{ m/s} + -7.0\text{ m/s})}{2} \times (3.4\text{ s})$$

$$= -15.3\text{ m}$$

The displacement of the cat during the 3.4 s period is – 15.3 m or 15. 3 m [W].

REF: UC LOC: UBC9

81. ANS:

$\vec{v}_1 = 20\text{ m/s [up]} = +20\text{ m/s}$

$\vec{v}_2 = 15\text{ m/s [up]} = +15\text{ m/s}$

$\Delta \approx = 2.3\text{ m [up]} = +2.3\text{ m}$

$\Delta t = ?$

$$\Delta t = \frac{2\Delta \vec{d}}{(\vec{v}_1 + \vec{v}_2)}$$

$$= \frac{2 \times +2.3\text{ m}}{+20\text{ m/s} + +15\text{ m/s}}$$

$$= \frac{4.6\text{ m}}{+35\text{ m/s}}$$

$$= 0.13\text{ s}$$

The ball took 0.13 s to accelerate from +20 m/s to +15 m/s and reach +2.3 m.

REF: UC LOC: UBC9

82. ANS:

$$\vec{a} = 1.0\ \text{m/s}^2\ [\text{E}] = +1.0\ \text{m/s}^2$$

$$\vec{v}_1 = 0\ \text{m/s}$$

$$\Delta \approx= 15.0\ \text{m}\ [\text{E}] = +15.0\ \text{m}$$

$$\Delta t = ?$$

$$\Delta \approx= \vec{v}_1 \Delta t + 1/2\,\vec{a}\,(\Delta t)^2$$

$$\Delta \approx= \frac{1}{2}\vec{a}\,(\Delta t)^2 \text{since } \vec{\text{v}}_1 = 0\,\text{m/s}$$

$$(\Delta t)^2 = \frac{2\Delta \vec{d}}{\vec{a}}$$

$$(\Delta t)^2 = \frac{2 \times +15\ \text{m}}{+1.0\,\text{m/s}^2}$$

$$(\Delta t)^2 = \frac{+30\ \text{m}}{+1.0\ \text{m/s}^2}$$

$$(\Delta t)^2 = 30\ \text{s}^2$$

$$(\Delta t)^2 = 5.5\ \text{s}$$

The rabbit took 5.5 s to accelerate from rest at 1.0 m/s^2 [E] for a total displacement of 15.0 m [E].

REF: UC LOC: UBC9

83. ANS:

$$\vec{v}_1 = 12\ \text{m/s}\ [\text{N}] = +12\ \text{m/s}$$

$$\vec{v}_2 = 0\ \text{m/s}$$

$$\Delta t = 12.0\ \text{s}$$

$$\Delta \approx= ?$$

$$\Delta \approx= \frac{\left(\vec{v}_1 + \vec{v}_2\right)}{2}\Delta t$$

$$= \frac{(0\ \text{m/s} + +12\ \text{m/s})}{2} \times (12.0\ \text{s})$$

$$= +72\ \text{m}$$

The displacement of the snowboarder during the 16.0 s period is +64 m or 64 m [N].

REF: UC LOC: UBC9

84. ANS:

$\vec{v}_1 = 0\text{ m/s}$

$\vec{v}_2 = 8.0\text{ m/s [N]} = +8.0\text{ m/s}$

$\Delta t = 6.0\text{ s}$

$\Delta \approx = ?$

$\Delta \approx = (\text{area of triangle}) + (\text{area of rectangle})$

$$\Delta \approx = \frac{(\vec{v}_1 + \vec{v}_2)}{2}\Delta t_1 + \vec{v}_2 \Delta t_2$$

$$= \frac{(0\text{ m/s} + +8.0\text{ m/s})}{2} \times (6.0\text{ s}) + (+8.0\text{ m/s}) \times (6.0\text{ s})$$

$$= +24\text{ m} + +48\text{ m}$$

$$= +72\text{ m}$$

The displacement of the snowboarder during the 12.0 s period is +72 m or 72 m [N].

REF: UC LOC: UBC9

85. ANS:

$\vec{v}_1 = 4.0\text{ m/s [N]} = +4.0\text{ m/s}$

$\vec{v}_2 = 10.0\text{ m/s [N]} = +10.0\text{ m/s}$

$\Delta t = 12.0\text{ s}$

$\Delta \approx = ?$

$$\Delta \approx = \vec{v}_1 \Delta t + \frac{(\vec{v}_1 + \vec{v}_2)}{2}\Delta t$$

$$= (+4.0\text{ m/s} \times 12.0\text{ s}) + \frac{(+4.0\text{ m/s} + +10.02\text{ m/s})}{2} \times (12.0\text{ s})$$

$$= +48\text{ m} + +84\text{ m}$$

The displacement of the snowboarder during the 12.0 s period is +132 m or 132 m [N].

REF: UC LOC: UBC9

86. ANS:

Galileo designed a pendulum clock to measure time precisely and he used an inclined plane to slow acceleration.

REF: UC LOC: DS1a

87. ANS:

$\vec{v}_1 = 0\,\text{m/s}$

$\Delta t = 15.0\,\text{s}$

$\vec{a} = 9.81\ \text{m/s}^2\ [\text{down}] = -9.81\ \text{m/s}^2$

$\vec{v}_2 = ?$

$$\begin{aligned}\vec{v}_2 &= \vec{v}_1 + \vec{a}\,\Delta t \\ &= \left(-9.81\,\text{m/s}^2\right) \times 15.0\ \text{s} \\ &= -147\ \text{m/s or } 147\ \text{m/s}[\text{down}]\end{aligned}$$

The velocity of the water balloon as it hits the sidewalk is 147 m/s [down]

REF: UC LOC: UBC7

88. ANS:

$\vec{v}_1 = 0\ \text{m/s}$

$\vec{v}_2 = 20\ \text{m/s}\ [\text{down}] = -20\ \text{m/s}$

$$\begin{aligned}\vec{v}_{av} &= \frac{\left(\vec{v}_1 + \vec{v}_2\right)}{2} \\ &= \frac{(0 + -20)\ \text{m/s}}{2} \\ &= -10\ \text{m/s or } 10\ \text{m/s}\ [\text{down}]\end{aligned}$$

The average velocity of the ball is 10 m/s [down].

REF: UC LOC: UBC9